**GRAPHING DRIVES ME NUTS**

**Pre-Lab Questions**

1. *Give at least two good reasons for making a graph of experimental data.*
2. *What does it mean to say that a “relationship” exists between two variables? How could you tell by looking at a graph if a relationship exists between the variables plotted on the horizontal and vertical axis?*

**Overview and Procedure**

In this activity, each group will have a nut-threaded bolt. You group will count the number of nuts and then use a balance to measure the mass of the combination. Do not remove the nut(s) from the bolt.

1. Post the data for your nut-bolt combination on the class data table.
2. Make your own data chart in which to record the class average for at least five combinations of these measurements.
3. Construct a graph by hand with “number of nuts” on the *x-axis* and “mass” on the *y-axis*. Organize and label the graph appropriately.

**Four Step Analyses**

When data are plotted, the graph may not be a straight line, but by manipulating the data a straight-line graph can often be produced. Once a straight-line graph is produced, apply the slope-intercept form of a straight-line equation (i.e., *y = mx + b*). In this equation x and y are generic experimental variables, and “m” and “b” are generic constants.

1. Write the equation in the form *y = mx + b*.
2. Replace the generic variables y and x with the actual variables used in the experiment. Remember that variables do not include units until specific values are substituted for a variable.
3. Replace the generic constants “m” and “b” with their numerical values from the data including units. Omit “b” as zero if it is close to zero, or logically should be zero. This is a specific equation.
4. Determine the physical significance of these constants. One way to do this is to consider the units associated with the constants. Another way is to consider the physical quantities that were constant during the experiment. Write the final general equation relating the variables and constants.

***Display your results on a whiteboard or other medium to present your conclusions.***

**Follow-up Question:**

1. Based on your graph, what does the y-intercept indicate about your nut-bolt combination? How can you test your response to this question?
2. Imagine you had determined the mass of the same set of nuts (in the same number sets as above) but without the bolt. Use a dotted line or a different color pencil to draw the best-fit straight line through the points. For each line, draw different shaped point protectors.
3. In large scale manufacturing, maintaining inventory can be an expensive challenge. How might ideas from this activity be used to help “count” an inventory of thousands of small and nearly identical components?